USGS Land Remote Sensing Program

Sustainable Land Imaging Users Forum
Operational Uses of Landsat Data

U.S. Department of the Interior
U.S. Geological Survey

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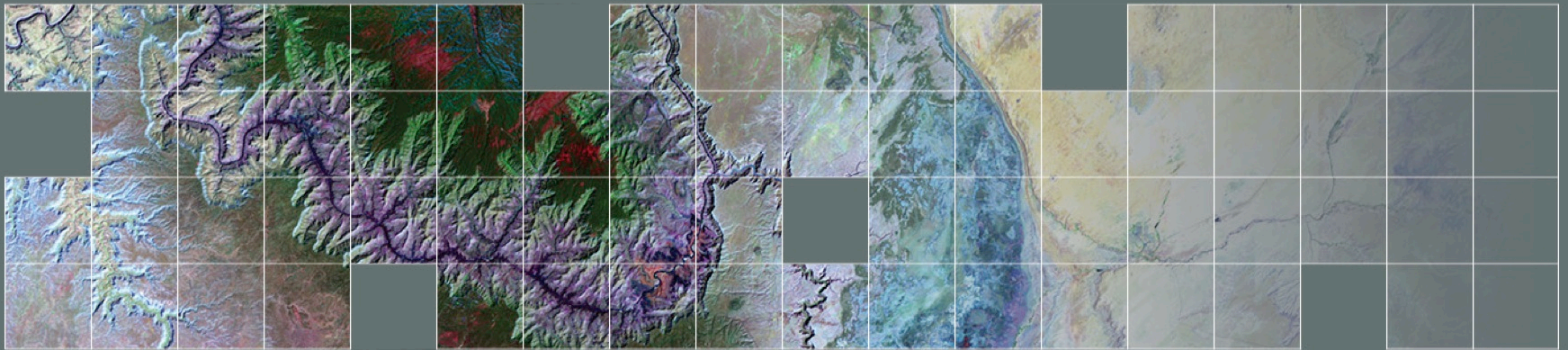
Session Overview

Objectives

- **Have a dialog with the user community to discuss user requirements and their relationship to the performance characteristics of operational land imaging systems and the effects that changes in these characteristics produce with regard to support for users' data application**

- **Discuss use cases which help illustrate and synthesize user requirements to support use by the Architecture Study Team in the assessment of various trade spaces associated with architecture concepts for a sustainable land imaging program for the Nation.**
    - Implementation strategies that could spur innovation & increase efficiencies
    - Consider international and private sector collaborations
    - Integration of hyperspectral data where appropriate
    - Lowering the cost of the system is an important goal

- **Three basic study tenets for the program**
    - Sustainability
    - Continuity
    - Reliability

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Performance Characteristics from USGS RFI in 2012

Table 2. Spectral and Radiometric Requirements for Surveyed Applications

Legend: ■ Required (green) | ■ Desired (blue)

Application	Information Product	Spectral Requirements						Radiometric Requirements	
		VIS	NIR	SWIR	TIR	Red Edge	Other	Calibration	Bit depth/SNR
National Land Cover Database (NLCD)	Cover Type/Change	Req	Req	Req				< 5% rad	
	% Treecover	Req	Req	Req				< 5% rad	
	% Impervious	Req	Req	Req	Req			< 5% rad	
USGS/USFS Landfire	Vegetation characteristics	Req	Req	Req	Req			< 5% rad	8-bits
	Disturbance	Req	Req	Req	Req			< 5% rad	8-bits
Burned Area Emergency Response (BAER)	Burn severity maps (dNDVI, dNBR)	Req	Req	Req					
FAO FRA Forest Change	Forest change maps	Req	Req	Req				< 5% rad	
Foreign Agricultural Service (FAS)	Crop area	Req	Req	Req					
	Crop production					Req			
	Crop health					Req			
National Agricultural Statistical Service (NASS)	National cropland data layer (crop type)	Req	Req	Req					
USDA Crop Insurance/Disaster	Verification of Crop Insurance/Disaster Claims	Req	Req	Req					
Western States Evapotranspiration	Land surface temperature				Req			<2% rad TOA	NEdT<1.5K
	Surface reflectance	Req	Req	Req				<5% SR	
	NDVI	Req	Req					<5% SR	
	Cloud/shadow mask	Req	Des		Req				
USDA Tillage/Residue Monitoring	Crop residue			Req	Req		Req		>250 SNR
Landsat Image Mosaic of Antarctica (LIMA)	Ice sheet features		Req					< 5% rad	12-bits
Minnesota Lake Clarity Monitoring	Water clarity	Req					Des	0.5% (?) TOA	12-bits
USFS Forest Management	Terrestrial Ecologic Unit Inventory	Req	Req	Req				<5% TOA	12 bits
	Mid-level Vegetation classification	Req	Req	Req				<5% TOA	12 bits
	National insect disease risk map (NIDRM)	Req	Req	Req				<5% TOA	12 bits
	Post-storm damage assessment	Req	Req	Req				<5% TOA	12 bits
	Rapid Assessment of Vegetation Post-fire (RAVG)	Req	Req	Req				<5% TOA	12 bits
MDA/NGA Land Change	Correlated land change (new construction)	Req	Req	Req	Des			stable TOA	> 11 bits
Ohio Agricultural Tax Verification	NDVI (to establish presence of crops)	Req	Req						
USGS Volcano monitoring	At-sensor radiance (plumes, minerals)	Req	Req	Req	Req		Des	<4% rad	
	Surface temperature				Req		Des	<4% rad	
USGS Flood Monitoring	At-sensor radiance (flooded area)	Req	Req	Req	Req			<4% rad	> 10 bits
USGS Essential Climate Variables (ECVs)	Surface reflectance	Req	Req	Req				<5% rad	> 10 bits
	Surface temperature				Req			<2% rad	> 10 bits
	Land cover & surface water extent	Req	Req	Req	Req			<5% rad	> 10 bits
	LAI/fPAR	Req	Req	Req				<5% rad	> 10 bits

Performance Characteristics from USGS RFI in 2012

Table 3. Temporal Revisit and Spatial Resolution Requirements for Surveyed Applications

Legend: ▮ Required (green) ▮ Desired (blue)

Application	Information Product	Revisit (days)	Resolution (m)	Geolocation (m)	Revisit < 4d	< 8d	<16d	<30d	Resolution <10m	<20m	<30m	<60m	< 100m
National Land Cover Database (NLCD)	Cover Type/Change	16	30	<15 m			▮				▮		
	% Treecover	16	30	<15 m			▮				▮		
	% Impervious	16	30	<15 m			▮				▮		
USGS/USFS Landfire	Vegetation characteristics	8	30	< 0.5 pix		▮					▮		
	Disturbance	8	30	< 0.5 pix		▮					▮		
Burned Area Emergency Response (BAER)	Burn severity maps (dNDVI, dNBR)	8 (4)	10 to 60	0.5 to 1.0 pix	▮	▮			▮	▮	▮	▮	
FAO FRA Forest Change	Forest change maps	16	30	< 0.5 pix			▮				▮		
Foreign Agricultural Service (FAS)	Crop area	7	30	coreg/ortho		▮					▮		
	Crop production	7	30	coreg/ortho		▮					▮		
	Crop health	7	30	coreg/ortho		▮					▮		
National Agricultural Statistical Service (NASS)	National cropland data layer (crop type)	5	30	coreg/ortho		▮					▮		
USDA Crop Insurance/Disaster	Verification of Crop Insurance/Disaster Claims	7	30	coreg/ortho		▮					▮		
Western States Evapotranspiration	Land surface temperature	16 (4)	30 to 120	< 15m	▮		▮				▮	▮	▮
	Surface reflectance	8	30	< 15m		▮					▮		
	NDVI	8	30	< 15m		▮					▮		
	Cloud/shadow mask	8	30	<15m		▮					▮		
USDA Tillage/Residue Monitoring	Crop residue	8	30 to 60			▮							▮
Landsat Image Mosaic of Antarctica (LIMA)	Ice sheet features	30 (7)	15	<50m (15m)		▮	▮		▮		▮		
Minnesota Lake Clarity Monitoring	Water clarity	8 (4)	50(30)	< 10m	▮	▮					▮	▮	
USFS Forest Management	Terrestrial Ecologic Unit Inventory	8	5 to 30	< 0.5 pix		▮			▮	▮	▮		
	Mid-level Vegetation classification	8	10 to 30	< 0.5 pix		▮					▮		
	National insect disease risk map (NIDRM)	8 (4)	30	< 0.5 pix	▮	▮					▮		
	Post-storm damage assessment	4	30	< 0.5 pix	▮						▮		
	Rapid Assessment of Vegetation Post-fire (RAVG)	4	30	< 0.5 pix	▮						▮		
MDA/NGA Land Change	Correlated land change (new construction)	30 (8)	30 (15)			▮	▮	▮		▮	▮		
Ohio Agricultural Tax Verification	NDVI (to establish presence of crops)	16	30			▮	▮						
USGS Volcano monitoring	At-sensor radiance (plumes, minerals)	16 (8)	30 (15)	< 0.5 pix		▮	▮			▮	▮		
	Surface temperature	16 (8)	60 to 90	< 0.5 pix		▮	▮					▮	▮
USGS Flood Monitoring	At-sensor radiance (flooded area)	8	30 (15)	< 0.5 pix		▮				▮	▮		
USGS Essential Climate Variables (ECVs)	Surface reflectance	8	30			▮					▮		
	Surface temperature	8	120			▮					▮		▮
	Land cover & surface water extent	16	30				▮				▮		
	LAI/fPAR	8	30			▮					▮		

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Questions for the User Community

How would you prioritize enhancing the system performance characteristics (spectral coverage, spatial resolution, revisit time, swath width, etc.) to satisfy or advance your particular applications?

How importance is instrument data calibration? To what extent could radiometric performance (signal-to-noise ratio, radiometric uncertainty) be relaxed?

How important is the simultaneity of spectral coverage in the VNIR-SWIR and TIR wavelength regions?

Do thermal data need to be collected in a sun synchronous orbit?

How important is the 10 am mean local crossing time?

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Questions for the User Community

What are your needs for data latency, e.g. turnaround time from sensor to product availability?

How important is global coverage and seasonal refresh?

Are there alternative data streams to those provided by the U.S. Government that should be pursued (e.g. international or commercial sources)?

Are there other sensor modalities that should be considered in the evolution of a sustainable land imaging program that could satisfy your applications requirements?

Are there different product types, access methods, and distribution services that the program should consider?

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How to Submit Feedback

- **Visit   http://espd.gsfc.nasa.gov/landimagingstudy/**

- **We have posted relevant materials from this User Forum on the web site**
  - Applications Requirements Worksheet
  - Slides from this session
  - Document that includes questions from this session

- **Mechanism for providing user feedback through the web site**
  - LandImagingUserFeedback@usgs.gov